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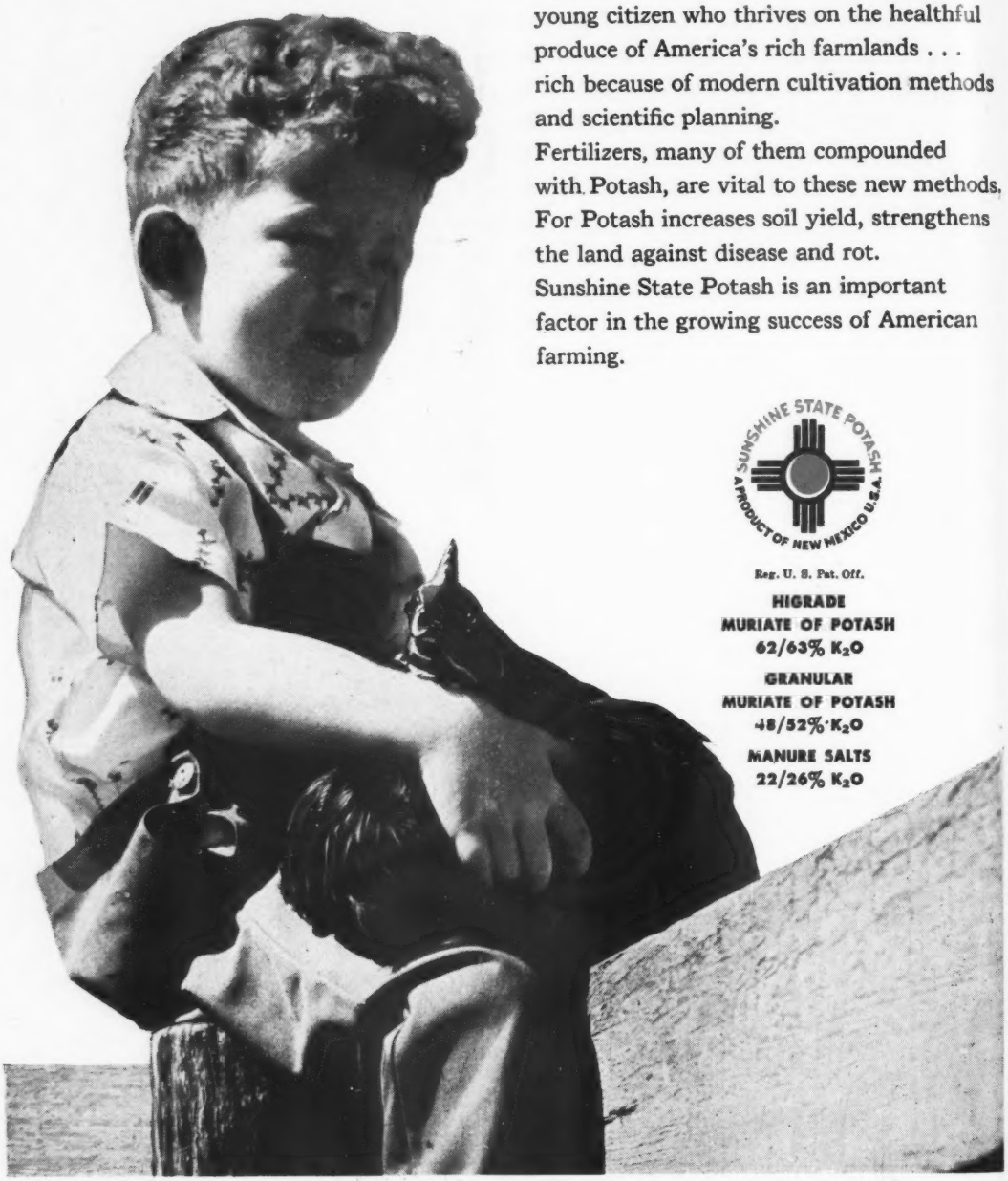

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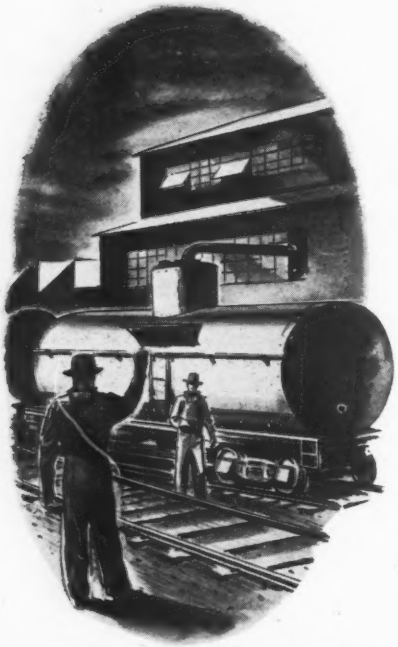

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The American FERTILIZER

Vol. 107 AUGUST 23, 1947 No. 4

The Influence of Soils & Soil Management Practices on Plant Food Requirements*

By W. V. BARTHOLOMEW[1]

IN CONTEMPLATING desirable fertilizer practices a number of factors come to mind. These factors for convenience of discussion fall into two general categories, namely, (1) the inherent fertility of the soil and the soil properties and environmental factors that have contributed to the present state of fertility, and (2) the crops, cropping systems and other management practices that influence the demand for fertilizer or the removal of nutrients from the soil.

Differences in Soils and Soil Fertility

Soils differ markedly in fertility. This statement is self-evident. Anyone who has observed crop yields and crop conditions, either locally or nationally, has come to this inevitable conclusion. The fertility elements, however, which limit crop production vary among soil areas.

Soil fertility differences are best expressed in terms of crop production—yield and quality of crops. As an illustration let us consider corn. It is grown in most areas of the United States. The average yields range from 15 to 20 bushels per acre in some of the Southeastern States to about 60 bushels per acre in some of the Midwestern States. Much higher yields can be grown even on the supposedly infertile soils. On the sandy coastal plain soils of the southeastern seaboard area, for example, corn yields of more than 100 bushels per acre have been produced. These yields were obtained, provided the soil was fertilized with adequate nitrogen, phosphorus and potassium. Equivalent yields can be obtained on the better soils in the corn belt States with little or no fertilization. Likewise, similar yields of corn may be grown on many of the soils in the western part of the country without the addition of any of the plant nutrients except nitrogen, provided the crop is supplied with ample moisture by means of irrigation. In these three areas the factors which limit corn yields differ markedly. In the West water and nitrogen are limiting. In the Southeast most of the major plant nutrients must be added to the soils for maximum crop production. In the Midwest fertility is much less critical than in most other areas, although profitable responses to fertilization are obtained in many of the soil areas.

Some of the fertility differences in the broad soil regions of the United States may be seen in Fig. 1. Nitrogen is low in the southeastern part of the United States and in the arid West. It is highest in the fertile prairie soils of the north central part of the country. Phosphorus is highest in the Pacific Northwest, and lowest

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* A paper presented at the Beltsville Fertilizer Conference, January, 1947.

in the southeastern seaboard area. Potassium is generally high in the western part of the country and low in the Southeast.

These soil fertility differences follow very closely the climatic and the resulting ecological patterns of the United States. Rainfall is highest in the eastern and southeastern parts of the country, and in the areas adjacent to the northern Pacific Coast. Mean annual temperatures are highest in the southern part of the country, with the exception of the Rocky Mountain highlands.

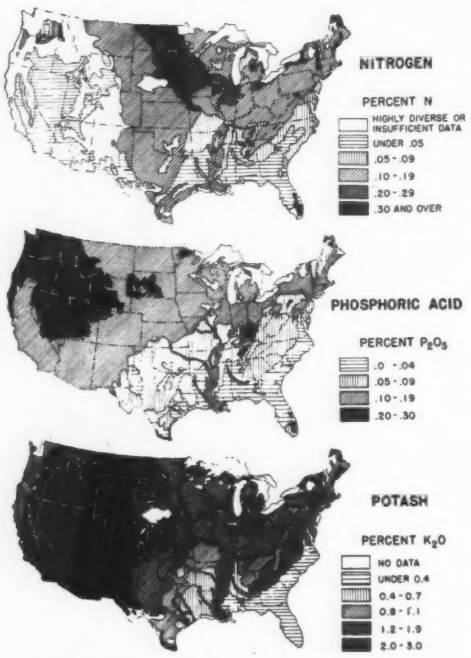

Fig 1. Plant Food in Surface Foot of Soil

Where rainfall and temperature are both high, an environment is produced which is most conducive to rapid and extensive weathering of the soil materials. As the weathering proceeds, large quantities of soluble plant nutrients are leached from the soil by the rain and carried from the land in the drainage waters. The resulting soils are relatively low in fertility and show considerable response to fertilization. Thus, in the Southeast most of the soils do not provide in any one season sufficient of the needed plant nutrients to produce 100 bushels of corn to the acre. It is necessary to provide the crop with these nutrients by the addition of fertilizers.

In the north central part of the United States the climatic factors have contributed to the formation of more fertile soils. Here rainfall is moderately high and the mean annual temperatures are much lower than in the South. The weathering processes have not been rapid or extensive. Where the native vegetation was grass, large quantities of organic matter have accumulated in the soil, providing a storehouse of the major plant nutrients. Fertilizer additions in the area, in general, are much less than in the southeastern region.

In the arid West moisture is the first limiting factor. Nitrogen has given general yield responses for certain crops and cropping systems under irrigation, and phosphorus needs have been recognized in some areas.

Climate alone is not responsible for the fertility differences between soil regions. The nature and composition of the parent material from which the soils were formed have a marked influence upon the properties of the resulting soils. These parent material differences have had an important influence upon the fertility levels of the soils from the various regions. This influence is difficult to evaluate in the regional picture because it is confounded with the influence of climate. The influence of parent material is clearly discernible within regions.

TABLE 1.
PLANT-FOOD CONSUMPTION BY REGIONS, 1941[1]

	Tons Plant Food per 1,000 Acres of Cropped Land		
	N	P_2O_5	K_2O
New England[2]	5.1	9.1	9.1
Middle Atlantic	2.9	11.0	5.2
South Atlantic	6.2	9.4	6.4
East North Central	0.4	2.3	1.4
West North Central	0.02	0.2	0.04
South Central[3]	1.4	1.6	0.7
Western	1.3	1.2	0.3

[1] Fertilizer data for 1941. Crop land data from 1940 census.
[2] State fiscal year 1940–41 for New Hampshire, Massachusetts, and Rhode Island.
[3] State fiscal year 1940–41 for Alabama, Arkansas, Louisiana, Oklahoma, and Texas.

American agriculture has long recognized these regional differences in fertility and has fertilized the soils accordingly. This is well illustrated in a comparison of regional fertilizer used (Table 1.).

Soils differ locally as well as between regions. In some areas these local differences are marked. An extreme example of local heterogeneity is to be found in the soils pat-

(Continued on page 22)

Development and Use of Fertilizer Materials in Relation to Higher Analysis Mixtures*

By K. D. JACOB[1]

(Continued from the issue of August 9, 1947)

Phosphate Materials

Ordinary superphosphate (18 to 21 per cent P_2O_5) furnished 80 per cent or more of the P_2O_5 consumed as fertilizer in most years of the period 1900 to 1945 (Fig. 2). For the last 15 years double superphosphate (43 to 48 per cent P_2O_5) has placed second, and in 1940 17.4 per cent of the P_2O_5 consumption was in the form of this material. During the war, however, diversion of elemental phosphorus to military purposes and lend-lease shipments to the United Kingdom caused a sharp decline in the supply of double superphosphate for domestic use.

The trend in the price differential between ordinary superphosphate and double superphosphate has been downward (Table 4). In 1945 the differential in the OPA ceiling wholesale price at East Tampa, Fla., a large producing point for both types of material, was 12 cents per unit of P_2O_5 in favor of ordinary superphosphate. Similarly, the differentials at Charleston, S. C., and Wales, Tenn., were 13 cents and 14 cents, respectively.

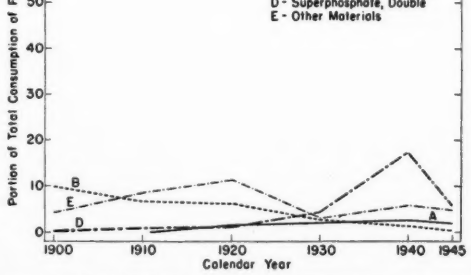

Fig. 2. Distribution of P_2O_5 Consumption Among the Various Materials

Of the total quantity of P_2O_5 used in mixed fertilizers, ordinary superphosphate supplies approximately 94 per cent, as compared with only about 3 per cent in the form of double superphosphate. In the case of P_2O_5, unlike nitrogen and potash, the high-analysis material—double superphosphate—is also the higher cost material. This fact doubtless accounts, at least in considerable part, for the relatively slow expansion in the use of double superphosphate.

In recent years much attention has been given to the production of several new phosphate materials — defluorinated phosphate rock (20 to 25 per cent P_2O_5), fusion products of phosphate rock and magnesium silicates (18 to 20 per cent P_2O_5), calcium metaphosphate (64 per cent P_2O_5), and potassium metaphosphate (37 per cent K_2O, 54 per cent P_2O_5). While the first two materials are in large-scale manufacture, they are basic in reaction and the concentrations are such that their use would contribute little or nothing to the production of higher analysis mixtures. Potassium metaphosphate and particularly calcium metaphosphate have been produced on rather large pilot-plant scales by the Tennessee Valley Authority. From the standpoint of concentration the metaphosphates would be very desirable for use in high-analysis mixtures. It remains to be seen, however, whether they can compete with other materials, for example, double superphosphate and the ammonium phosphates, on the basis of unit costs.

*A paper presented at the Beltsville Fertilizer Conference, January, 1947.

[1]Principal Chemist, Division of Soils, Fertilizers, and Irrigation, Bureau of Plant Industry, Soils, and Agriculture Engineering, Agricultural Reasearch Administration, U. S. Deptment of Agriculture, Beltsville, Md. Grateful abknowledgement is made to F. W. Parker for helpful advice and suggestions, and to A. L. Mehring for assistance with the statisical data.

Potash Materials

Among the potash carriers, 60 per cent potassium chloride furnished 80 per cent of the total consumption of K_2O as commercial fertilizer in 1945 but only 9 per cent in 1930 (Fig. 3). It was during this period that production of potash materials from the Western deposits was expanded to supply by 1945 more than 95 per cent of the domestic consumption of fertilizer K_2O. On the other hand, kainit (12 to 22 per cent K_2O), which supplied 25 per cent of the potash in 1900, disappeared from the market in 1938.

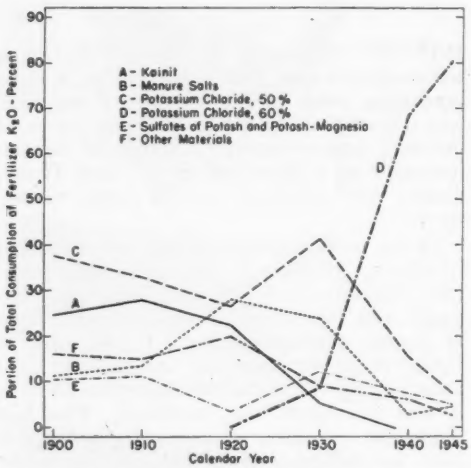

Fig. 3. Distribution of K_2O Consumption Among the Various Materials

Manure salts (20 to 30 per cent K_2O) furnished about 24 per cent of the potash in 1930, as compared with only 3 per cent in 1940 and 5 per cent in 1945. The increased use of this material in 1945 over 1940 was due to the greatly increased demand for potash in the face of inability to expand further the facilities for producing the higher grade chloride during the war. Owing to the higher price of manure salts (about 14 cents per unit in 1945) its use should, undoubtedly will, decrease as augmented supplies of the chloride become available. It will be noted that the use of manure salts dropped sharply and the consumption of potassium chloride increased rapidly when the price of the former per unit of K_2O became higher than that of the latter (Table 4 and Fig. 3).

Potassium sulphate has been in short supply for several years. Owing to the price differential between it and the chloride (26 cents per unit in 1945), consumption of the sulphate will continue to be restricted to those crops, principally tobacco and citrus, which are adversely affected by the chloride ion.

Potassium chloride is the most concentrated as well as the cheapest of the potash carriers and our large resources in the Western deposits assure an ample supply of this material for many years to come. Of the three major plant foods the wholesale price of potash in the form of the chloride (54 cents per unit) was the lowest in 1945. Potash is in a unique position with respect to low-cost, high-analysis material suitable for use in the preparation of mixtures covering the entire range of feasible concentrations.

TABLE 5

RETAIL PRICE, WHOLESALE COST OF MAJOR PLANT FOODS, AND PROCESSING AND DISTRIBUTION COSTS OF AN AVERAGE TON OF FERTILIZER PURCHASED BY FARMERS IN CONTINENTAL UNITED STATES[1]

Calendar Year	Retail price paid by farmers,[2] dollars	Wholesale cost of N P_2O_5 and K_2O, dollars	Processing and distribution costs[3] Dollars	Portion of retail price, %
1925	38.30	19.60	18.70	48.8
1926	36.60	19.53	17.07	46.6
1927	34.80	19.82	14.98	43.0
1928	36.90	20.81	16.09	43.6
1929	34.70	19.76	14.94	43.0
1930	33.80	18.59	15.21	45.0
1931	29.90	16.35	13.55	45.3
1932	25.70	13.35	12.35	48.1
1933	23.80	13.70	10.10	42.4
1934	28.20	14.43	13.77	48.8
1935	28.50	14.13	14.37	50.4
1936	30.10	14.89	15.21	50.5
1937	30.80	15.87	14.93	48.5
1938	30.20	15.69	14.51	48.0
1939	30.50	15.88	14.62	47.9
1940	30.30	16.58	13.72	45.3
1941	31.70	17.99	13.71	43.2
1942	35.70	16.89	18.81	52.7
1943	39.20	17.50	21.70	55.4
1944	40.00	18.12	21.88	54.7

[1] Transportation, processing, and distribution costs include freight on materials (superphosphate, potash, and nitrogen) from ports to interior points, or, in the case of superphosphate, higher production costs at interior plants due to the freight on rock and sulphur; therefore, these figures are somewhat higher than those which may be calculated from retail price schedules.
[2] Delivered-to-the-farm, cash price.
[3] Includes the producer's and dealer's profit and the cost of inert filler and conditioner and of secondary and minor plant foods.

Factors in Retail Price of Fertilizer

The retail price of fertilizer may be resolved into two components: (1) the wholesale cost of the major plant foods (N, P_2O_5, and K_2O) and (2) the processing and distribution cost, including the producer's and dealer's profit and the cost of filler, conditioner, and secondary and minor plant foods. Table 5 shows this breakdown for the average ton

(Continued on page 26)

Conference on Model Fertilizer Bill Scheduled

An effort to iron out differences over the proposed Model State Fertilizer Bill, parts of which have been criticized by fertilizer manufacturers, will be made at a conference in Washington on October 18th, it was announced recently by Assistant State Agriculture Commissioner D. S. Coltrane.

Coltrane is president of the Association of American Fertilizer Control Officials and is chairman of the committee which spent two years drafting the proposed bill, which has been adopted as written only by West Virginia. Parts of the measure were incorporated in the North Carolina law by the 1947 General Assembly.

Invitations to attend the meeting have been sent to the American Plant Food Council, the National Fertilizer Association and national farm organizations. Officials of these groups have been asked by Coltrane to meet with the Model Bill Committee and try to agree in principle on the proposed bill, which was designed to make state fertilizer laws more adequate and uniform.

The conference is scheduled to begin at 9:30 A. M. in the Shoreham Hotel.

Coltrane also announced that a meeting of the Association of Fertilizer Control Officials would be held at the Shoreham on October 21st. It will be an open meeting, with representatives of the fertilizer industry invited to attend and participate in the discussions. A program now is being drafted.

Ohio Wheat Will Pay for More Fertilizer

Larger amounts of fertilizer applied on Ohio wheat fields are recommended by Earl Jones, extension agronomist, Ohio State University, who suggests 400 to 500 pounds per acre on fields where alfalfa or clover will be seeded in the grain.

Most Ohio farmers fertilize for wheat but the average application a few years ago was 200 pounds per acre. With higher prices for grain and with only moderate increases in fertilizer prices, Mr. Jones believes it is good business to put on more fertilizer.

This agronomist says liberal use of fertilizer helps the chances of getting a good legume seeding which will provide a lot of good feed and improve the soil. Meadows left two years or more should get an application of fertilizer the second year and each alternate year afterward that the meadow is kept.

Farmers who want to use 3–12–12 or 4–12–8 fertilizer on wheat are advised to get orders in early and to use some other suitable analysis if the one wanted is not available. When manure has been applied regularly, fertilizers containing no nitrogen may be used to improve wheat yields.

Mr. Jones explains that the amounts of phosphorus and potash are very important in wheat fertilizers, and that more potash should be used than has been customary in past years. He thinks about equal amounts of the two ingredients in a wheat fertilizer will bring the biggest increase in yields per acre.

Hammond Bag Acquires Plant at Pine Bluff, Ark.

Now in its 25th Anniversary Year, the Hammond Bag and Paper Company, whose main offices and plants (Paper Mill and Bag Factory) are located at Wellsburg, W. Va., announces the leasing of a plant at Pine Bluff, Ark., to be used exclusively for the manufacture of multi-wall paper bags.

The newly acquired single story fire-proof building will enable the Company to increase its productive capacity 50 per cent. Most of the modern bag-making machinery and equipment required has already been installed, and more is scheduled for early delivery. Approximately one hundred persons will eventually be employed to operate the plant.

Allen E. Weaver, who has been with the company at the Wellsburg Plant for fourteen years, will be the production manager at the new Pine Bluff Plant. He brings to his new position a broad experience in all phases of multi-wall bag manufacture. Mr. Weaver has gained recognition as an expert on multi-colored printing and has inaugurated many improvements that have enabled the company to hold its place in the forefront of the industry in quality printing.

Better service on Multi-Wall Bags to customers in the Central and Southwest is now assured from the Pine Bluff plant. This plant on the Missouri Pacific and Cotton Belt Railroads, and the Company's main plants at Wellsburg, now give Hammond two strategic locations for servicing all paper-bag customers east of the Rocky Mountains.

To supplement the new capacity at Pine Bluff, the Company's plants at Wellsburg are likewise being expanded.

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Ammonium Nitrate Handling Regulations

The recent explosion of a burning ship loaded with ammonium nitrate, in the harbor of Brest, France, following so closely on the Texas City disaster, has caused a number of port authorities in this country to either ban entirely or restrict sharply the water shipment of this material from their ports. This has caused the U. S. Coast Guard, which has jurisdiction over water shipments, to recommend to all port cities that they pass regulations prohibiting the loading or unloading of ammonium nitrate within their borders except in isolated areas where danger to property and life would be minimized. Some cities have followed this advice. The Coast Guard has issued an order prohibiting the loading on or unloading from any vessel of any ammonium nitrate in amounts exceeding 500 pounds unless a permit to do so has been issued by the proper Coast Guard authority, and further states that no such permit will be issued for loading or unloading except at isolated facilities within the port.

On rail shipments, the Interstate Commerce Commission is expected to issue, in the near future, regulations covering this material. It is expected that these will require that all shipments in customary 100-and 200-pound bags be marked with a yellow label denoting that it is an oxidizing material, supporting combustion by liberating oxygen. The new regulations may require the same label on tank car shipments.

Meanwhile, an official interdepartmental committee consisting of representatives from the Government agencies Army, Navy, Coast Guard, Maritime Commission, Treasury, Commerce, Bureau of Standards, Bureau of Mines, Interstate Commerce Commission, and Agriculture, and with the addition of an observer from the State Department and representatives from the Bureau of Explosives of the Association of American Railroads, is making a complete study of the material and the precautions that must be observed in its handling, transportation, and use. The committee expects to make a preliminary report very soon.

The President's conference on fire prevention and the War Department have also joined the list of authorities who are taking action to regulate the handling of ammonium nitrate.

Major General Philip B. Fleming, Federal Works Administrator, and general chairman of the conference on fire prevention, has called a hearing for September 8th to discuss methods of reducing fire hazards of chemicals, particularly the danger of ammonium nitrate when stored aboard ship.

Among those present at the conference will be representatives of cities from whose ports ammonium nitrate shipments are likely to be made and laboratory technicians making special studies of the properties of ammonium nitrate.

The War Department stepped into the picture with issuance by the transportation corps of safety regulations governing loading and stowing of the nitrate for which it has the responsibility for shipment.

The department is committed to supply such fertilizer to occupied areas in Europe and Asia in order to increase the production of food within those areas and thereby reduce the burden of shipments from the United States and other parts of the world.

The transportation corps said it is believed rigid adherence to the regulations will practically eliminate the possibility of a fire occurring on the vessel during loading and stowing operations. "Since the recent explosions on vessels carrying ammonium nitrate have occurred after fire has been in progress for periods ranging from one hour to six hours," it explained, "the prevention of fire appears to be one of the primary considerations in the prevention of other accidents of the same kind." None of the recent nitrate explosions occurred on American ships or vessels that were being loaded by military personnel, it was pointed out.

There is no question that ammonium nitrate is a highly inflammable substance, as are some other fertilizer materials, and that the necessary precautions should be strictly observed in its handling and storage. Authorities have stated, however, that the material will explode only after it has been ignited and then subjected to a severe shock. This seems to have been the conditions under which the explosions occurred in Texas City and Brest. In the past there have been a number of fires where quantities of ammonium nitrate were consumed, but no explosion occurred.

For more than twenty years, no dynamite or black powder has been involved in any kind of accidental explosion during transit over the rails of the United States and Canada. During the recent war, over 50,000,000 tons of military explosives were carried by rail without any disaster. In handling haz ardous materials, good regulations and efficient inspection will provide adequate safety and will permit their use in every important branch of industry. Ammonium sulphate is an increasingly important fertilizer material and can be used without danger if the regulations are observed.

Charging Off Fertilizer Costs

A plan for charging off fertilizer costs has been used by account keepers in Illinois for the past 25 years. This plan, according to specialists from Illinois College of Agriculture, J. B. Cunningham, Farm Management Specialist, and A. L. Lang, Chief in Soil Experiment Fields, should not be changed from year to year after having once adopted it.

Their recommendations for charging off the cost of a normal application of nitrogen, phosphate, and potash, whether applied individually or in combination, should be charged off in one year, whereas a heavier than average application should be charged off in three years. Other suggestions from these specialists are that the cost of limestone be charged off in five years and the cost of rock phosphate be charged off in ten years.

For accounting purposes, a normal application is:

1. Less than 100 pounds per acre of total plant food (nitrogen, phosphoric acid, and potash) in a mixed fertilizer, such as 2–12–6, 3–12–12, 8–8–8, and 0–20–20. For example, 300 pounds of 2–12–6 contains 60 pounds of plant food.
2. Less than 60 pounds per acre of plant food (phosphoric acid) in superphosphates, such as 0–20–0 and 0–45–0.
3. Less than 100 pounds per acre of plant food (potash) in potash-fertilizer materials, such as 0–0–50.
4. Any amount of nitrogen fertilizer.

A heavy application is more than the amounts listed.

A heavy application is more than the amounts listed.

These recommendations serve to distinguish between outlays for plant-food materials which increase productivity over a period of years and those from which the benefit is of short duration. The former are considered capital investments to be charged off over a period of years, and the latter are expenses to be charged off the year the fertilizers are applied.

July Tag Sales

Fertilizer tax tag sales in sixteen States for July, the first month of the new fiscal year, reached an all-time high, according to reports of State control officials to The National Fertilizer Association. This new high point in July sales is, in part, an encouraging manifestation of the growing trend on the part of American farmers to buy fertilizer early.

Tax tag sales in sixteen States for July amounted to 417,000 equivalent short tons. This was an increase of 13 per cent over the 368,000 equivalent tons sold a year ago and 71 per cent over the 244,000 tons reported for July, 1945. For the five years 1935–1939 the July average was only 46,000 short tons, so July sales for this year represent an increase of 797 per cent.

For the eleven Southern States, July tag sales were equivalent to 209,000 tons, an increase of 0.4 per cent over the preceding July, 49 per cent over July, 1945, and 480 per cent over the July average for the years 1935–1939. Compared with July, 1946, July tag sales increased for six of the eleven Southern States with increases ranging from 2 per cent for Virginia to 69 per cent for Texas—the other five States showed decreases.

The five Midwestern States reported total tag sales of 207,000 tons for July. This represented slightly less than 50 per cent of total sales in the 16 States, an unusually high percentage for these five States. Sales were 30 per cent higher as compared with the preceding July and were more than twice as high as sales during July, 1945. July sales were also more than 19 times greater than the 1935–1939 July average. Tag sales in each of the five Midwestern States were higher than for a year ago, with increases ranging from 6 per cent for Indiana to almost 100 per cent for Kentucky.

Tag sales for January–July, amounting to 6,159,000 equivalent short tons, were 2 per cent below the reported tonnage of 6,308,000 for the same period last year, but 9 per cent above January–July sales for 1945. Cumulative sales for the sixteen Southern States amounted to 4,985,000 tons, a decrease of 6 per cent from January–July of 1946; five of the eleven States reported increases but the other six States registered decreases ranging from 2 per cent for Georgia to 18 per cent for Florida. Sales in the five Midwestern States, on the other hand, were 15 per cent above the first seven months of last year, with only Missouri failing to record an increase.

Collis Elected President of Federal Chemical Company

At a recent meeting of the Board of Directors of the Federal Chemical Company, fertilizer manufacturers of Louisville, Ky., John V. Collis was elected President, and Jefferson D. Stewart, Jr., Vice-President of the Company. Both of these new officers have been connected with the Company for more than ten years.

FERTILIZER TAX TAG SALES
Compiled by The National Fertilizer Association

State	July				January–July		
	1947	1946	1945	% of	1947	1946	1945
	Tons	Tons	Tons	1946	Tons	Tons	Tons
Virginia	24,830	24,299	27,152	101	457,329	453,995	414,614
North Carolina	35,352	25,438	7,750	96	1,161,987	1,205,586	1,155,132
South Carolina	19,954	21,118	12,440	93	624,201	674,561	666,465
Georgia	17,746	15,100	15,503	98	897,223	918,948	893,328
Florida	39,484	52,773	44,568	82	467,594	571,726	486,519
Alabama	29,350	22,750	12,500	84	587,150	700,500	617,800
Tennessee	14,717	16,770	5,326	102	250,144	246,425	227,735
Arkansas	.....	9,550	8,250	106	133,830	126,100	106,400
Louisiana	4,850	6,302	3,050	93	127,480	136,613	129,386
Texas	19,846	11,719	3,700	106	229,863	216,801	149,785
Oklahoma	3,000	2,500	.....	146	47,792	32,798	16,412
Total South	209,129	208,319	140,239	94	4,984,593	5,284,053	4,863,576
Indiana	102,047	95,925	74,705	111	429,068	386,658	303,194
Illinois	31,900	22,975	11,350	128	242,175	188,483	153,539
Kentucky	21,188	10,600	9,450	113	271,342	240,961	227,633
Missouri	28,525	14,718	4,785	98	170,186	174,471	94,783
Kansas	23,775	15,000	3,140	185	61,548	33,227	24,005
Total Midwest	207,435	159,218	103,430	115	1,174,319	1,023,800	803,154
Grand Total	416,564	367,537	243,669	98	6,158,912	6,307,853	5,666,730

FERTILIZER MATERIALS MARKET

NEW YORK

Summer Lull Continues with Contracts Placed for All Available Material. Increase of $4.00 in Price of Chilean Nitrate of Soda Announced. Organic Feed Materials Increase in Price. Ammonium Nitrate Shipping Regulations Being Considered.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, August 19, 1947.

The summer lull, which developed a few weeks ago, is continuing. Most fertilizer manufacturers have placed contracts for as much materials as the producers feel they can turn out during the coming season. The principal item of interest was the rise in the price of Chilean nitrate of soda from $38.50 to $42.50 in bulk at the ports. There has been no increase to date in the prices for domestic nitrate of soda, much of which is used in the chemical trade. The fertilizer industry is still uncertain regarding the shipment of ammonium nitrate, following the recent explosion of a ship at Brest, France. It is hoped that some practical and adequate regulations for the handling of this material can be prepared from the study now being made by government, railroad and insurance authorities.

Sulphate of Ammonia

Prices on sulphate of ammonia continue unsettled. Contracts for future shipment specify prices prevailing at the time of each shipment. Just now, this is running from $30 to $38 per ton, depending on location of producing plant. All material produced is being taken by the fertilizer mixers and no reserves are accumulating at the producing ovens.

Nitrate of Soda

Chilean nitrate of soda is now quoted at $42.50 per ton in bulk, carload lots, f.o.b. cars at the ports. This is an increase of $4.00 per ton over previous quotations. An additional $3.00 per ton is charged for material in 100-pound paper bags. For less-than-carload lots or for delivery to trucks, an additional 50 cents per ton is charged. No change has been announced for domestic nitrate but it is expected that there will be some increase before long.

Ammonium Nitrate

The explosion of another burning nitrate ship in Brest, France, has caused a number of U. S. port authorities to severely restrict the shipment of this material in any amount exceeding a few hundred pounds. A joint committee representing government and railroad officials are working on the problem and hope to arrive at satisfactory regulations which will protect against another disaster and at the same time permit this important fertilizer nitrogen to move freely in domestic and foreign trade.

Organic Materials

The approach of fall and winter, with increased use of feeding material, has stimulated the producers of organics to strengthen prices. As high as $9.00 per unit of ammonia ($10.94 per unit N) has been asked for tankage and sales are reported at $8.75 ($10.63 per unit N). Fishing has been good on the Atlantic coast and meal is offered at from $125 to $135 per ton, depending on protein content.

Superphosphate

Nothing of importance to report on this material. Producers have contracted for a very large part of their future production and mixers would take much more if it were possible to get it. Meanwhile, acidulators are running to the limits of capacity and phosphate rock available, and monthly output reports are breaking previous records.

Phosphate Rock

The recent price advance has had no effect on sales and superphosphate producers are

taking all that can be mined. There are still no accumulation of reserves at the mines and, in spite of increased production facilities, it is expected that every available ton will be used throughout the current fertilizer year.

Potash

Shipments on contracts are moving steadily and are taking the entire current production. Mixers could use much more than the potash people have been willing to contract for, as, in spite of their apportioning sales among customers, the producing companies have sold practically their entire year's output.

PHILADELPHIA

Slackening in Inquiries for Spot Materials. Large Portion of Available Future Production Contracted For.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, August 18, 1947.

Inquiries for prompt fertilizer materials have dropped off, as is usual at this season of the year. Active interest continues, however, in future deliveries, with inquiries for greater quantities than are likely to be produced.

Sulphate of Ammonia.—The market is strong with the average price about $35.00 but ranging up to $38.00 per ton, in bulk, f.o.b. works. Much of the production is covered by contracts, but movement is said to be retarded somewhat by car shortage.

Nitrate of Soda.—While there is the usual seasonal absence of interest, there is no easement in the supply position. An advance in price of Chilean nitrate has been announced. This is $4.00 per ton, bringing the carload bulk price to $42.50 per ton, and the bag price to $45.50, at the usual ports of discharge.

Nitrate of Ammonia.—Production in general is heavily under contract. It is feared that some of the smaller mixers may avoid use of this article because of its dangerous reputation, and this, added to the recent export loading restrictions and France's embargo, may increase the quantity available to those mixers who are not afraid. On the other hand, there is the chance that other nitrogen chemicals may be exported in lieu of ammonium nitrate, thus reducing the potential nitrogen supply for the timid mixer.

Castor Pomace.—No new business reported. Movement only on contracts.

Blood, Tankage, Bone.—The feeding trade demand for these organics continues fairly active. While the tankage price worked up to better than $8.25 per unit of ammonia ($10.02 per unit N), when it got above this, interest began to lag. Blood remained more or less steady at $7.00 to $7.50 per unit of ammonia ($8.51 to $9.12 per unit N). Steamed bone, 70 per cent BPL, was quoted at $58.50 per ton.

Fish Scrap.—The menhaden catch was somewhat off due to bad weather. Prompt scrap was quoted at $112.50 to $115.00 f.o.b. factory, with September delivery at $120.00 —bags extra. Eastern sardine meal, 60 per cent protein, was quoted at $118.00 f.o.b. factory; menhaden meal, 60 per cent, at $134.00 prompt, and $129.00 for delivery later in the year. Business was with feeding trade.

Phosphate Rock.—Demand continues strong at recently advanced prices. It is reported that Canada is taking steps to expedite the development of her phosphate deposits.

Superphosphate.—Demand is still at high level, with producers not anxious for new business. There are plenty of orders to be had.

Potash.—Shipments continue to move on contract, with some complaint of car shortage. Demand is strong.

CHICAGO

Quotations on Fertilizer Nitrogenous Tankage Continue to Rise. Feed Market Unsettled.

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, August 18, 1947.

It has again been demonstrated that there are some manufacturers, both large and small, who have confidence in the continuation of advancing nitrogenous prices for later deliveries. Sales have been reported at 50 cents per unit higher than last quotations.

In the feed market wide price ranges prevail. Producers reported that the demand was far in excess of available supplies, especially for meat scraps.

CHARLESTON

Fertilizer Mixers Still Searching for Materials for the Coming Season. Box Car Shortage Hampers Shipments

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, August 18, 1947.

Fertilizer manufacturers continue interested in purchasing supplies of the three main ingredients for the coming season's mixing. Solid nitrogen, potash and superphosphate, although produced in greater quantities than

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ever before, appear to be insufficient in quantity to meet the expected demand. Prices are firm and reasonably upward.

Organics.—The market is firm and upward because offerings are relatively scarce as fertilizer manufacturers come into the market for their new season's requirements of organics. Domestic nitrogenous from one producer has recently advanced in price from $6.00 to the present $6.50 per unit of ammonia ($7.90 per unit N) f.o.b. Midwestern point. Another producer of nitrogenous has been selling at $5.25 per unit ($6.38 per unit N) with an escalator clause. South American organics continue at prices above domestic buyer's views. No recent reports of further United States purchases of European organics.

Castor Pomace.—Crushing operations, it is reported, have been hampered due to the difficulty in obtaining castor beans. No recent offerings are reported. Price is nominally $37.50 per ton, f.o.b. works.

Potash.—Movement is made against contracts and suppliers are heavily booked for the new season. Demand is in excess of supply and prices are firm and unchanged.

Nitrate of Soda.—Demand continues strong in spite of the usual drop in demand for this time in the season. Importation and production by domestic producers is insufficient to meet the call.

Ammonium Nitrate.—For this area, the price effective is $48.50 per ton in bags f.o.b. works. Demand is exceedingly strong and due to the heavy export schedule, the supply for domestic users is expected to be short for the coming season.

Dried Ground Blood.—Offerings are scarce and the asking price is as high as $8.25 per unit of ammonia ($10.02 per unit N) f.o.b. Midwestern points in bulk.

Phosphate Rock.—Demand is strong but the mines are hampered in making deliveries due to the shortage of freight cars as a result of the movement of grains to the ports at the present time. Prices are firm and upward.

Superphosphate.—This material continues in heavy demand and production is hampered by inability of acidulators to get sufficient phosphate rock and sulphuric acid.

Obituary

Dr. S. E. Peterson

Dr. S. E. Peterson died on July 27th, at the age of 59 years. Dr. Peterson attended Northwestern University and was graduated from McKillep Veterinary College. He practiced Veterinary Medicine at Forreston, Ill. Later he entered the government service in the Bureau of Animal Husbandry in Chicago during World War I.

Becoming interested in the advertising field, he decided to specialize in Nutrition and Agriculture, and was associated with the E. H. Brown Advertising Agency of Chicago. Dr. Peterson was Chief Veterinarian and Husbandry Counselor for Ultra-Life Laboratories, East St. Louis, Ill., and edited the *Ultra-Life Journal.* He was also associated with J. B. Sedberry, Inc., Franklin, Tenn.

Dr. Peterson is survived by his widow, Agnes E. Peterson; one son, S. Marshall Peterson of Corte Madera, Calif.; two brothers, Harry and Paul Peterson, and three sisters, Emma Foguburg, Lillian Wohlstrom, and Myrtle Starkey.

June Sulphate of Ammonia

Production of by-product sulphate of ammonia during June, 66,195 tons, was only 2 per cent smaller than the May output, indicating that the daily average tonnage was being maintained at high levels. Shipments dropped to 61,917 tons, which increased

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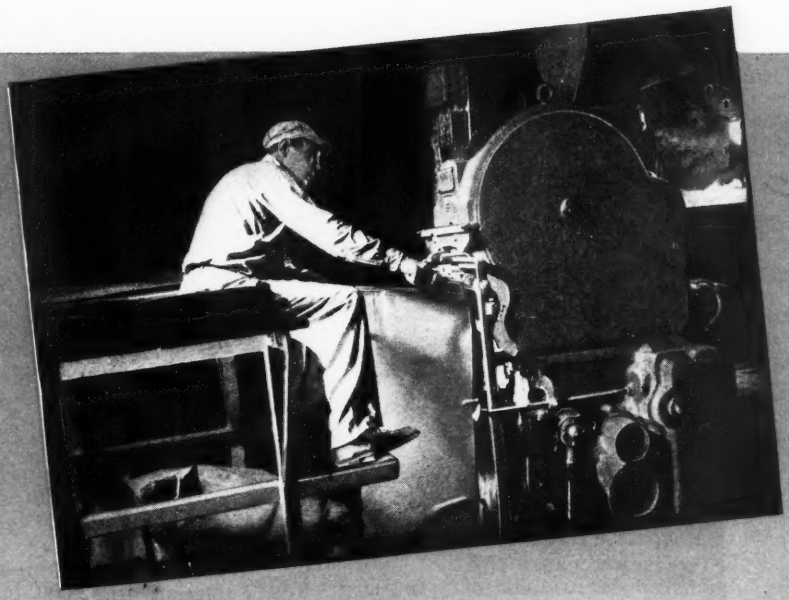

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stocks on hand at the end of the month to 22,444 tons. In addition to the above figures, compiled by the U. S. Bureau of Mines, the output of synthetic sulphate of ammonia (technical grade), as reported by the Census Bureau, was 16,801 tons.

	Sulphate of Ammonia Tons	Ammonia Liquor Tons NH_3
Production		
June, 1947	66,195	2,263
May, 1947	67,649	2,396
June, 1946	54,632	1,868
January–June, 1947	395,865	13,953
January–June, 1946	266,495	11,389
Shipments		
June, 1947	61,917	2,260
May, 1947	67,867	2,178
June, 1946	45,438	1,631
Stocks on Hand		
June 30, 1947	22,444	709
May 31, 1947	18,921	852
June 30, 1946	25,170	627

St. Regis To Build Pacific Bag Plant

Roy K. Ferguson, President of the St. Regis Paper Company, N. Y., has announced plans for construction of a $6,000,000 kraft paper mill and multiwall bag plant at Tacoma, Wash., site of the Company's large sulphate pulp mill. Announcement was made following a meeting of the Board of Directors.

Construction contemplated by St. Regis includes several buildings. The paper mill will require a two-story building 72 feet wide and 612 feet long. This building will house a paper machine designed to produce multiwall grade kraft paper 168 inches wide at a rate of 2,000 feet per minute. This will mean the production of 240 tons of this type of paper every twenty-four hours.

The multiwall bag plant will consist initially of a two-story building approximately 360 by 364 feet. It is estimated that the actual cost of construction of this building will be about $2,000,000, exclusive of machinery. Plans also call for future addition to this building which would be approximately 200 by 364 feet. The primary bag plant would be designed to convert about 50,000 tons of kraft paper a year into multiwall bags.

Superphosphate Production Breaks Record

Production of superphosphate for the fiscal year 1946–1947 amounted to 9,506,000 equivalent short tons (basis 18% A. P. A.), according to reports submitted to The National Fertilizer Association and a summary of reports submitted to the Bureau of Census. Production during the recently completed fiscal year was 13 per cent greater than the 8,430,000 tons produced during the 1945–1946 fiscal year.

The 8,557,000 tons of normal superphosphate (basis 18%) produced during the past fiscal year, constituting 90 per cent of total production, was 11 per cent greater than the 7,678,000 tons produced during the 1945–1946 fiscal year. At the same time, the production of 52,000 tons of wet base goods (18% basis), which represented 0.5 per cent of total production, was an increase of 8 per cent over the 48,000 tons produced during the 1945–1946 period.

Compared with the 1945–1946 fiscal year, the most significant change has been in the production of concentrated superphosphate. During the recently completed July–June period, production of concentrated superphosphate (basis 45%) amounted to 359,000 short tons, or almost 10 per cent of total production; this represented an increase of 27 per cent over the 282,000 tons of concentrated superphosphate (45% basis) produced in the 1945–1946 fiscal year. This 27 per cent increase is indicative of the efforts of the fertilizer industry to supply farmers with this type of fertilizer.

SUPERPHOSPHATE PRODUCTION, FISCAL YEARS

	1945–46	1946–47
Total Superphosphate (18% basis)	8,430,293	9,505,627
Normal Superphosphate (18% basis)	7,678,316	8,556,672
Wet Base Goods (18% basis)	47,912	51,695
Concentrated Superphosphate (45% basis)	281,625	358,904

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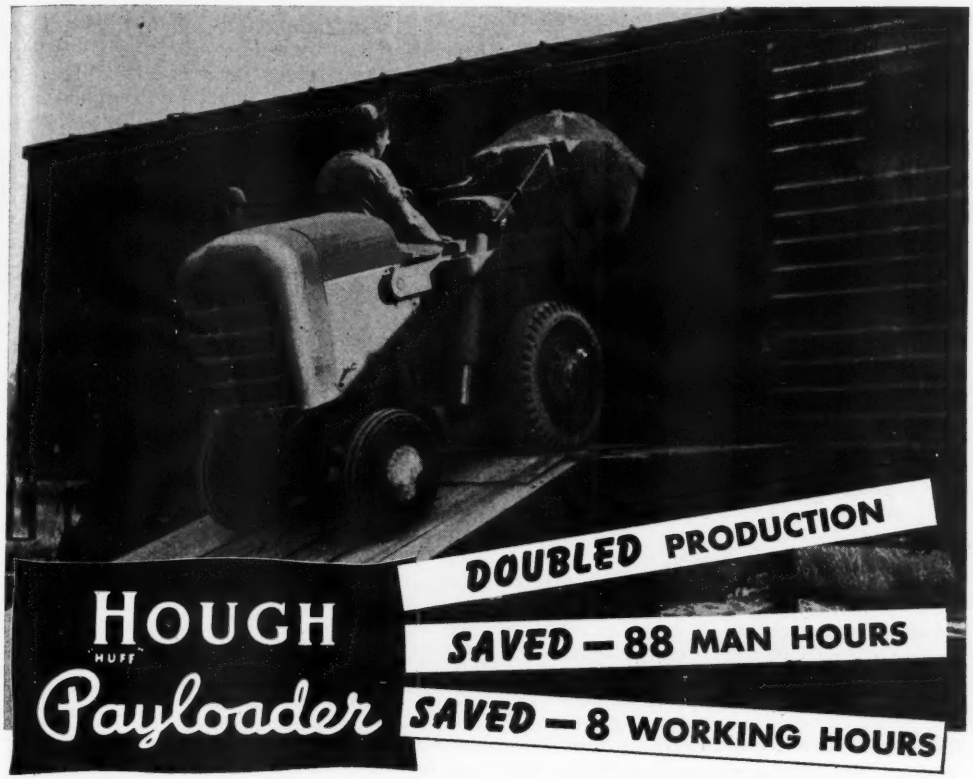

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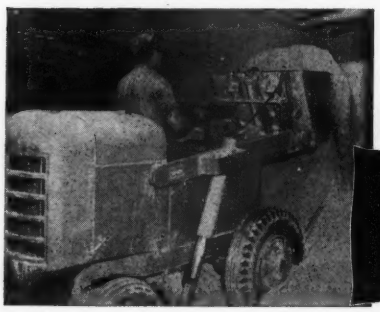

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SOILS AND SOIL MANAGEMENT

(Continued from page 8)

tern of Fauquier County, Virginia. Here in one county is to be found some of the best agricultural soils of the area intermixed or adjacent to some of the poorest soils in the region. The soil groups follow the geologic pattern in the area and occur as narrow bands transversing the county in a northeast-southwest direction. The Chester-Brandywine and Fauquier-Meyersville groups are good agricultural soils and are relatively high in fertility. They have supported a prosperous agriculture for a hundred years. The Nason-Tatum and Culpepper-Louisburg groups, on the other hand, are among the most infertile soils of the region. Most of the Nason-Tatum area is in native forest or has been allowed to revert to forest after having failed to support a paying agriculture.

Differences in parent material have been chiefly responsible for the differences occurring in soil and soil fertility in Fauquier County. The lines of demarkation between the various soil areas are often sharp. It is not uncommon to pass from a fertile field producing good yields of crops to an infertile area not capable in its present condition of supporting a paying agriculture, all within the distance of less than a few hundred yards.

Management Practices Influence Fertilizer Use

Soil fertility factors markedly influence fertilizer usage, but they are by no means the exclusive factors considered in determining desirable levels of fertilizer application. Under conditions of comparable soil fertility desirable fertilizer practices may vary rather widely. On a given farm or a specific soil type, fertilizer usage will be determined not only by the fertility status of the soil, but also by (1) the cash value of the crop to be grown, (2) the crop sequence or rotation used, (3) the type of farming followed (general, dairy, truck crops, etc.), and (4) the tillage practices employed. No doubt there are other factors not here considered which are important and influential in determining fertilizer usage.

The farmer applying the fertilizer wishes to obtain the greatest return for his expenditure of money and time. It will be profitable for him to fertilize only if the crop yield and quality increase obtained are of sufficient magnitude to compensate for the expense of applying the fertilizer.

The cash value of the crop to be grown is an important factor in determining whether or not fertilizer applications are likely to pay dividends. Where soils are relatively infertile, there is a greater likelihood that fertilization will be profitable. This is because increments of fertilizer added are more likely to result in large increases in the yield and quality of the crop. As increased increments of fertilizer are applied, however, the law of diminishing returns becomes important and the point will be reached where the increased increment of fertilizer will no longer result in yield increases of sufficient magnitude to pay for the

TABLE 2.
CROP ACREAGE AND FERTILIZER USE IN RELATION TO CROP VALUE PER ACRE[1, 2]

Crop Group	Proportion of Cropland in Indicated Crops	Proportion of Fertilizer Used on Indicated Crops	Index Numbers of Acre Use of Fertilizers (All Crops = 100)	Index Numbers of Acre Value of Crops (All Crops = 100)
	Per cent	Per cent		
Vegetables	0.83	7.10	863	681
Fruits and Nuts	1.89	8.75	462	509
Intertilled Field Crops	44.54	67.03	150	129
Small Grains	33.47	13.32	40	74
Hay	19.27	3.80	20	60

[1] *Fertilizers and Lime in the United States*, U.S.D.A. Misc. Pub. No. 586.
[2] Average for 1924, 1928, 1932, and 1936.

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fertilizers. Where the cash value of the crop is high, the small yield increases are profitable even though relatively high rates of fertilizer must be applied to obtain them. That this factor has been very influential in determining rates of fertilization is shown by the data in Table 2. Vegetables are high cash value crops. The average per acre rates of fertilization are much higher among these crops than among any other crop categories.

TABLE 3.
PLANT-FOOD REMOVAL BY VARIOUS CROPS[1]

Crop	Yield	Part of Crop	N	P_2O_5	K_2O	Total
			lbs.	lbs.	lbs.	lbs.
Alfalfa...	3 tons	all	140	35	135	310
Timothy..	1.5 tons	all	40	15	45	100
Corn.....	60 bu.	grain	57	23	15	95
	2 tons	stover	38	12	55	105
		total	95	35	70	200
Wheat...	30 bu.	grain	35	16	9	60
	1.25 tons	straw	15	4	21	40
		total	50	20	30	100
Potatoes..	300 bu.	tubers	65	25	115	205
		tops	60	10	55	125
		total	125	35	170	330
Sugar beets...	15 tons	roots	55	22	53	130
		tops	60	23	92	175
		total	115	45	145	305

[1] J. D. Romaine. "When Fertilizing Consider Plant-Food Content of Crops." Reprinted from *Better Crops with Plant Food Magazine.*

Crops vary in their nutrient requirements. This is shown by the data in Table 3. Alfalfa requires relatively large quantities of the plant-food elements. Since the nitrogen requirements of alfalfa are usually supplied by symbiotic fixation, only the mineral plant-food elements must be supplied by soil or by fertilization. A 3-ton crop of alfalfa will remove from the soil about 35 pounds of P_2O_5 and 135 pounds of K_2O. A 60-bushel crop of corn, on the other hand, will remove about 23 pounds of P_2O_5 and 15 pounds of K_2O, or a 30-bushel crop of wheat will remove only about 16 pounds of P_2O_5 and 9 pounds of K_2O.

Crops also differ in their seasonal requirements for mineral nutrients. For maximum crop production the available plant food in the soil must be sufficient to meet the needs of the crop during the season of maximum uptake. The demand for plant nutrients by corn is greatest during the midsummer rapid growing season. Fall wheat, on the other hand, requires a supply of mineral nutrients early in the growing season. Alfalfa because of its normally long growing season has a steady but longer seasonal demand for plant-food elements than either corn or wheat.

Crop sequences likewise are important. Where liberal fertilization is needed to produce a particular crop, the following crop may be produced with little or no fertilization. Where certain legumes are used in the rotation, the need for nitrogen fertilizer is reduced. Krantz[2] found that turning under a good cover crop of winter peas was equivalent to the addition of about 60 pounds per acre of nitrogen to the succeeding crop of corn.

[2] B. A. Krantz. "Corn Fertilization Studies." Agron. Information Cir. No. 142, North Carolina Agr. Expt. Sta. 1945.

(To be continued in the next issue)

June Superphosphate Production

Production of superphosphate during June of this year amounted to 802,000 equivalent short tons (basis 18% A. P. A.). Compared with the 643,000 tons produced during the preceding June, this was an increase of 25 per cent. June production, however, was 10 per cent lower than the 892,000 tons produced during May and, in fact, was lower than production for any other month of

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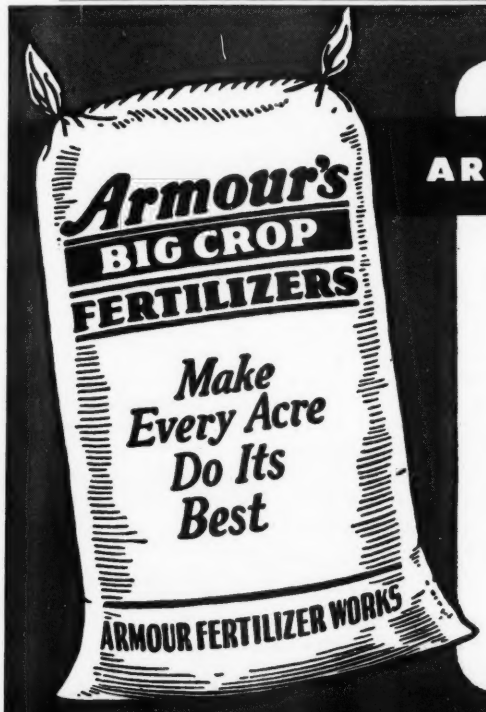

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1947. Shipments during June were 7 per cent greater than for a year ago, while superphosphate used in mixed goods increased 46 per cent over the preceding June.

Cumulative statistics reveal that total January–June production of superphosphate (basis 18%) amounted to 5,114,000 short tons, an increase of 19 per cent over the same period last year. Total disposition of superphosphate during January–June was greater than for a year ago.

	Normal Super 18% A.P.A.	Concentrated 45% A.P.A.	Base Goods 18% A.P.A.
Production			
June, 1947.....	721,562	30,698	3,821
May, 1947.....	803,406	33,151	5,761
June, 1946.....	583,952	22,910	1,756
Shipments and Used in Producing Plants			
June, 1947.....	570,431	29,794	3,190
May, 1947.....	750,550	30,626	4,602
June, 1946.....	478,552	19,623	1,699
Stocks on Hand			
June 30, 1947..	705,454	58,433	3,815
May 31, 1947..	534,241	57,524	3,184
June 30, 1946..	550,408	45,790	2,261

FERTILIZER MATERIALS IN HIGH ANALYSIS MIXTURES

(Continued from page 10)

of fertilizer (both mixtures and materials) purchased by farmers through commercial channels in 1925 to 1944. The data for the years prior to 1942 are from Shaw, Parker, and Ezekiel.[4]

In 1936 to 1941 the retail price of fertilizer averaged $30.60 per ton and showed, in general, only small variations from year to year. Subsequently, the price increased sharply until in 1944 it was $40.00 or 31 per cent more than the 1936–1941 average. Processing and distribution costs averaged 47.2 per cent of the retail price in 1936 to 1941 and 54.3 per cent in 1942 to 1944. Prior to 1936 the average percentage was 45.9. It is evident, therefore, that there has been a definite trend toward higher processing and distribution costs in comparison with the wholesale cost of carriers of the major plant foods.

[4] Shaw, B. T., Parker, F. W., and Ezekiel, M. J. B., "Price Factors in Plant-Food Consumption," Ind. Eng. Chem. 37, 282–288 (1945).

[5] Ross, W. H., and Mehring, A. L., "Plant Food Concentration as a Factor in the Retail Prices of Fertilizers," Ind. Eng. Chem., News Ed. 12, 430–432 (1934).

Although the two cost factors are not greatly different in magnitude, there appears to be a much better opportunity for lowering the retail price of fertilizers by decreasing the processing and distribution costs than by decreasing the wholesale cost of materials. With mixed fertilizers, in particular, processing and distribution costs per unit of plant food can usually be reduced considerably by increasing the plant-food concentration through decreased use of inert filler and of low-analysis, high-cost materials.[5] The saving which can be made in this manner is, in general, much larger than that which can be effected by foreseeable reductions in the wholesale costs of the individual fertilizer materials.

With certain assumptions, one can easily demonstrate the magnitude of the saving that may be effected in the cost of plant food to the farmer by increasing the concentration of mixed fertilizers. For example, let it be assumed that:

(1) The wholesale unit cost of plant food (N, P_2O_5, and K_2O) in the fertilizer is constant and does not vary with the concentration of the mixture. This is true within certain limits of concentration.

(2) The processing and distribution cost is $24.00 per ton of mixed fertilizer, regardless of the plant-food content. This figure, which seems reasonable, compares with $21.88 as such cost for an average ton of all fertilizer (both mixtures and materials) purchased by farmers in 1944. In fact, the percentage saving that can be effected for a given percentage increase in plant-food concentration is constant and is independent of the value assigned to the processing and distribution cost.

(3) The computation is based on 20 per cent as the average plant-food content of the mixed fertilizers actually used. In reality the mixtures consumed in 1944 averaged 21.12 per cent of plant food. The relation to the saving in cost to plant-food concentration can be followed more easily, however, by using a figure of 20 per cent.

Table 6 shows the savings in the cost of plant food in mixed fertilizers that are possible on the basis of the foregoing assumptions.

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Under the stated conditions, the cost of 400 pounds of plant food (the quantity contained in one ton of 20 per cent fertilizer) could be decreased $12.00 by doubling the concentration. A saving of $4.80 (40 per cent of the total saving over the selected range of concentrations) could be effected by increasing the plant-food content to only 25 per cent. Important but progressively smaller savings are indicated for each additional 5 per cent increase in the concentration.

TABLE 6

RELATION OF CONCENTRATION TO THE COST OF PLANT FOOD IN MIXED FERTILIZER

Concentration of plant food, %	Equivalent quantity of fertilizer, pounds	Processing and distribution cost, dollars	Saving Dollars	Saving Portion of total, %
20	2,000	24.00	.....	.....
25	1,600	19.20	4.80	40.0
30	1,333	16.00	8.00	66.7
35	1,143	13.72	10.28	85.7
40	1,000	12.00	12.00	100.0

Admittedly, the concentration of a fertilizer having a 1:2:1 plant-food ratio, for example, cannot be increased from 20 per cent to 40 per cent, or even to 30 per cent, by the use of only the lowest cost materials that are currently available. It can be increased, however, to 25 per cent by the use of such materials, provided a basic or neutral mixture is not required. For a neutral mixture the limit is about 20 per cent. Assuming the availability of suitable higher analysis, though higher priced, materials which would permit the production of mixtures having concentrations of 30 per cent or more, the possible saving in processing and distribution costs would warrant their use to an extent governed principally by the wholesale cost of the plant food in such materials.

In the foregoing discussion no consideration is given to the advantage of higher concentration as related to the distribution of the fertilizer in the field. Assuming equally good physical condition and drillability, this is an advantage which accrues to the farmer even though the higher concentration does not result in a decrease in the delivered-to-the-farm unit cost of plant food. It may even be such that the farmer would be justified in paying a higher unit price for the more concentrated mixture.

Concentration Goals in Higher Analysis Fertilizers

The attainment of goals in programs for increasing the concentration of mixed fertilizers involves, among other things, the very important problems of filler and natural organics, both of which will be discussed at some length in subsequent papers on this program, as well as the more effective use of the high-analysis, low-cost, chemical fertilizer materials that are currently in quantity production. Furthermore, the plant-food ratios prevailing in the principal mixtures used in a given region may be the major factor limiting the production of higher analysis fertilizers from the available materials.

For the country as a whole, reduction in the use of added filler appears to offer the greatest opportunity for increasing the concentration of fertilizers and lowering their cost to the farmer. To make the best of this opportunity will necessitate (1) that most of the inert filler added merely for make-weight purposes be eliminated and (2) that the use of inert conditioning agents be reduced to a minimum. The question of neutralizing filler, added for the purpose of overcoming the physiological acidity of nitrogen salts, constitutes a more complicated phase of the problem. While complete elimination of such filler will probably not be advisable until such time as an adequate farm liming program is firmly established throughout the country, it is important to note that many States already have such a program and that progress to this end is being made in other States. The need for neutralizing filler should be re-examined in the light of the present situation and steps taken to reduce its use to the lowest levels consistent with the needs of the individual States.

The natural organic carriers of nitrogen have low analysis, extremely high unit cost, and great variability in crop-producing value. At best, the nitrogen generally appears to be more effective than chemical nitrogen, while it is often of very inferior quality. The inclusion of natural organics in fertilizers should be limited to mixtures intended for crops and localities definitely known to show economic response to nitrogen in this form as compared with the returns from the use of chemical nitrogen.

The fullest use should be made of such high-analysis, chemical nitrogen materials as the ammoniating solutions, ammonium nitrate, and urea. As the quantity of ammoniating solution that can be used in a mixed fertilizer is proportioned directly by the superphosphate content of the mixture, it appears that the quantity of nitrogen consumed in this form can be doubled if the superphosphate in all mixed fertilizers is ammoniated to the maximum practicable limit. To accomplish this

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fully it would be necessary, however, to eliminate mixtures in which the $N:P_2O_5$ ratio is 1:4 or less. Such mixtures, which contain more superphosphate than corresponds to the ammoniation equivalent of the nitrogen content, accounted for about 30 per cent of the total tonnage of mixed fertilizer consumed in 1945.

Aside from the saving that can be effected by expanded use of high-analysis nitrogen materials in mixed fertilizers, a large saving can be made in the cost of nitrogen for direct application. The magnitude of the possible saving is indicated by the facts (1) that the consumption of nitrogen in the form of sodium nitrate, nearly all for direct application, amounted to about 164,000 tons in 1945 and (2) that the unit wholesale cost of nitrogen was $1.75 for sodium nitrate as compared with $1.42 for nearly pure, solid ammonium nitrate.

As higher concentration is the principal problem in the case of phosphatic materials, every effort should be made to encourage the production and consumption of double superphosphate and other high-analysis products to the extent that this will result in decreased costs of fertilizer to the farmer. Taking into account the relation between higher analysis and lower processing and distribution costs per unit of plant food, there are many areas where it would be economically advantageous either to augment the P_2O_5 content of mixed fertilizers by additions of double superphosphate or else to supply the P_2O_5 wholly in this form. Provision of an adequate supply of high-analysis phosphate would remove an important obstacle to progress in increasing the concentration of mixtures.

As previously pointed out, neither the cost nor the concentration of the principal potash material (potassium chloride) is a handicap to the preparation of higher analysis mixtures. Nevertheless, an unrestricted supply of the chloride would result in an increase in the plant-food concentration of mixed fertilizer in at least some sections of the country, for example, in the North Central States where a considerable portion of the large consumption of 2–12–6 fertilizer (about 1,000,000 tons in 1945) would undoubtedly be replaced by mixtures of higher K_2O content. Manure salts should be eliminated from use in mixed fertilizers as soon as the supply of the higher analysis, lower cost potassium chloride is sufficient fully to meet the potash requirements.

Assuming adequate supplies of materials of suitable analysis and cost and bearing in mind the regional aspects of fertilizer concentration and use as influenced by agronomic practices, soil and plant requirements, and other factors, the following levels of plant food in mixed fertilizers should be possible of attainment by 1950:

Region	Plant-food concentration in 1950, %	Increase over concentration in 1945, %
New England	29–32	2.0–5.0
Middle Atlantic	25–28	1.5–4.5
Southern	21–24	1.5–4.5
Midwestern	27–30	3.0–6.0
Western	26–30	2.5–6.5
United States	24–27	2.5–5.5

For the country as a whole, attainment of the indicated goals could result in a saving of as much as $5.00 per ton in the cost of mixed fertilizer, as compared to the cost in 1944. To reach these goals will require, however, the concerted efforts of all agencies, both public and private, concerned with the production and use of fertilizers and fertilizer materials.

Summary

Trends in plant-food consumption and in the concentration, cost, production, and use of fertilizer materials are discussed in relation to the outlook for higher analysis mixed fertilizers. While much progress has been made in increasing the plant-food content of fertilizer materials and mixed fertilizers, the concentration of the materials used has increased at a decidedly faster rate than that of the mixtures produced.

The relation of concentration to the retail cost of plant food in mixed fertilizer is emphasized, and it is shown that important saving in the processing and distribution cost can be made by producing mixtures of only moderately higher analysis. To effect the greatest saving in this manner will require (1) that use of inert filler and conditioner, neutralizing filler, and the low-analysis, high-cost natural organics be reduced to a minimum and (2) that the maximum use be made of the high-analysis, low-cost materials currently available. Expanded use of higher analysis phosphate materials, even at unit wholesale costs somewhat higher than that of P_2O_5 in the form of ordinary superphosphate, will be economically advantageous in large areas of the country.

Concentration goals for mixed fertilizers, considered to be possible of attainment by 1950, are suggested. These goals range from 21 to 24 per cent total plant food for the South to 29 to 32 per cent for the New England States. The figure is 24 to 27 per cent for the United States.

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Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.

DRYERS
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City

FERTILIZER (Mixed) MANUFACTURERS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
International Minerals and Chemical Corporation, Chicago, Ill.
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Virginia-Carolina Chemical Corp., Richmond, Va.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
McIver & Son, Alex. M., Charleston, S. C.

FOUNDERS AND MACHINISTS
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Utility Works, The, East Point, Ga.

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Sturtevant Mill Company, Boston, Mass.
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IMPORTERS, EXPORTERS
Armour Fertiliser Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Bradley & Baker, New York City.
Southern States Phosphate & Fertilizer Co., Savannah, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.
McLaughlin Gormley King Co., Minneapolis, Minn.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Bradley & Baker, New York City.
Longview-Saginaw Lime Works, Inc.., Birmingham, Ala,
McIver & Son, Alex. M., Charleston, S. C.

LOADERS—Car and Wagon
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MACHINERY—Acid Making and Handling
Chemical Construction Corp , New York City.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Utility Works, The, East Point, Ga.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Company, Boston ,Mass

MACHINERY—Elevating and Conveying
Hough Co., The Frank G., Libertyville, Ill.
Hayward Company, The, New York City.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

MACHINERY—Grinding and Pulverizing
Bradley Pulverizer Co., Allentown, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Sedberry, Inc. J. B., Franklin, Tenn.
Stedman's Foundry and Mach. Works, Aurora, Ind.
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Hough Co., The Frank G., Libertyville, Ill.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
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MACHINERY—Mixing, Screening and Bagging
Exact Weight Scale Co., Columbus, Ohio
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

MACHINERY—Power Transmission
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Superphosphate Manufacturing
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Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.

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Sturtevant MillCompany,Boston, Mass.
Utility Works, The, East Point, Ga.

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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.

NITROGEN SOLUTIONS
DuPont du Nemours & Co., Wilmington, Del.
Lion Oil Company, El Dorado, Ark.
Spencer Chemical Co., Kansas City, Mo.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PHOSPHATE ROCK
American Agricultural Chemical Co. New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Virginia-Carolina Chemical Corp., Richmond, Va.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City
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POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
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International Minerals & Chemical Corporation, Chicago, Ill.
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American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
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PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
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Exact Weight Scale Co., Columbus, Ohio
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SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
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SULPHUR
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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
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Ashcraft-Wilkinson Co., Atlanta, Ga.
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Schmaltz, Jos. H., Chicago, Ill.
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U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
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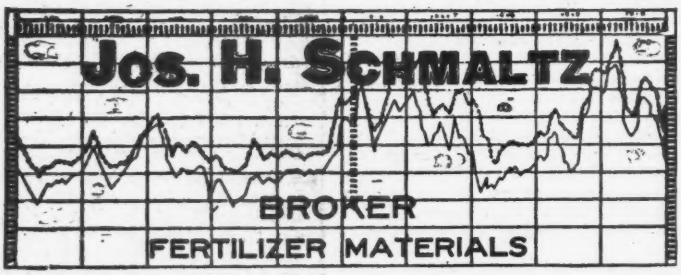

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